3/15/05
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Notes from March 10 Water-Energy Relationship Working Group Meeting

The Water-Energy Relationship Working Group was organized by staff of the California Energy Commission and the Department of Water Resources to provide guidance and assist in the study of water use in the energy sector, and energy use in the water sector. The group consists of agency personnel at the local, regional, and state level; university researchers, industry organizations, and non-profit groups. These notes were originally intended for internal use only, and the staff scribe did not keep track of who was speaking. In the interest of an open discussion of the issues, the Water-Energy Relationship Working Group has agreed to publicly release the notes of their first meeting, and to publicly release the transcripts of all future meetings.

Water Cycle Stages

1. Primary water extrication, conveyance, storage and supply delivery (imported & local)
2. Treatment and distribution within service area
3. On-site pumping, treatment, and thermal inputs (heating and cooling)
4. Wastewater collection and treatment

Bin (Issues to be dealt with later)

1. May have different number of stages. Can be flexible.
2. Need to add energy use to water uses
3. Add natural gas impacts for completeness (water heating important)
4. Gas use (numerator) should be measured in equivalent kWh. Assume electricity at central power plant. Use heat rates for conversion.
5. Electricity is ~ 85% of energy. Natural gas-fueled pumps are a significant part of conveyance
6. Need to decide what to do about natural gas and diesel.

The Water Energy Nexus led by Bob Wilkinson, UCSB

- Step 1: characterize and watch supply options (energy intensity, mix)
- DWR has data
- Natural gas engines are significant

- Peak electricity impacts decrease when natural gas engines are used
- Raw data is useful
- Model doesn't address peak impacts, only annual energy use
- ACWA is looking at peak impacts
  - mostly in Southern California
  - components of potential to shift peak by customer class.

- DWR
  - Sometimes conversions to equivalents are useful

- Denominator: MG
  - Question: Where were they measured? Does it account for conjunctive use, evaporation, etc? Need to measure at consistent point.

- metered wastewater

- is evaporation something we really need to know?
- Maybe non-trivial in desert areas
- What is bang for buck? Surface evaporation is a function of surface area not volume of water

- Big data gaps:
  - Energy to pressurize and circulate water in buildings. May need data from water engineers (treatment, pumping, uses, thermal aspects) (thermal is mostly cooling). Depends on sector. Huge data gap!!!
  - energy to pump from treatment plant to end-user is a big gap
  - need to understand crossover and benefit tradeoffs. Water use per capita is decreasing and energy is increasing
  - ACWA does not have energy number- is working on identifying peak impacts
  - Distribution will be affected by growth (some planned and an unknown amount unplanned). Most growth is further from water/wastewater treatment plants. Treatment and distribution tend to be aggregated but would be good to break out.

- ACWA asked to get totals
- We have better data for wastewater treatment than water treatment; reason: wastewater is consistent but water treatment varies by source.
- Issue: water needed in the future and energy needed.

- Big data gap in groundwater use.
- ACWA: existing conjunctive use data available by end of April (won't have information on new fields)
- DWR has a process to look at water use scenarios and responses to characterize energy and water use.
- Energy used for water per household increasing because of distribution. But water use per household is decreasing because of conservation.
- water is treated more heavily now and is getting more expensive. More treatment and more regional facilities implies more pumping implying more energy use by facilities
- need to understand components of energy and water

- there is a data gap on primary water extraction
- Distribution and end use are biggest data gaps
- Treatment of Brackish water is a big data gap. Do we know energy as a function of TDS?
- Need to find source of new water to know energy & cost implications
- Need to know where houses are going.
- What regulations affect the level of treatment required?
- Ag. Land conservation
- DWR bulletin 160
- Agricultural use might get more water-intensive as cropping patterns change (i.e. to vineyards, etc.)
- Regionality is a factor
- Over ½ of energy use is on customer side of meter (in San Diego)
- pumping groundwater was small but is expected to grow
- water transfers are more of an issue
- water trades are more of an issue
- poor information about groundwater pumping and energy use for groundwater pumping Professor Burt has a good study

Afternoon Discussion

Climatic Conditions
Hydrologic Conditions of Concern

Drought

Extended (what energy effects of long term drought)
What happens 1st year? 2nd year? 3rd year? Etc.
Shifting pattern: Less snow pack? More rain?

Warming

Less snow

(note: the human water demand confounds the impact of drought)

In San Diego they get water from Colorado River and may have shortage even if much rain in area

Drought will affect hydro and lead to more gas powered generation

Definition of drought: Model scenarios used by DWR

Drought events reduce the “less important” uses of water

Increased variability of precipitation affects hydro storage and thus affects storage, releases, and flood control

Scenarios to consider are: extended drought, high variability, change in snow pack, timing of runoff

With less surface water farmers pump more

Timing of run-off:

- If earlier in spring- what energy impact? Answer: Less generation from reservoirs and less available water captured implying more energy intensive water used.

Greater variability:

- This is a planning challenge and may become more conservative (leading to more spills or shortages). Storage gets more valuable
- High valued crops need steady water supply so there may be a shift to lower valued crops.

Subsurface storage becomes more valuable than surface water storage. Note: pumping costs increase in subsurface storage

Generally, water supply and energy are trade off’s. Relative prices have an impact on water and energy used

There are many models for climate forecasting but how that impacts energy is still unknown

ACWA will ask members about water usage scenarios during drought

Water agencies have drought management plans with actions at various stages

DWR snowpack reports are good for information on this year's water supplies

Study from Bureau of Reclamation: uses portfolio management techniques (pay more for reliable resources of water).

Water market data reveals willingness to pay

Demand in urban areas for industrial and commercial is very inelastic. Residential water demand is more elastic (they may let lawns die, etc.)

Need research on agricultural pumping as a function of drought (PG&E projections don't change as function of the length of drought)

Need electricity use by agricultural district

- at farm level electricity usage correlates with pumping and surface water availability and cost

Pumping is a function of electricity price and depth compared to cost of surface water (non linear relationship)

Note: Semitropic has good relations with farmers and might be willing to share what they are learning.

ACWA has task force on climatic impact and water supply

In State Water Plan, much water loss is recoverable in groundwater but has an energy cost to pump it up. Need to consider energy impacts as well as water.

Look at groundwater table in Eastside W.D

In wet years, water might be over applied to recharge groundwater

Conjunctive use component becomes more important because won't have more surface water storage: big energy impacts

Don't know potential connected load of pumps. In a drought they may all come on.

ACWA is asking questions on pumping capacity and operations. Can figure out how long turned on but research won't directly ask this.

Semitropic is now a distribution customer and pumps are attributed to them. Other pumps further away might be connected to PG&E

Conjunctive use pumping has an unknown time horizon. (although, DWR has scenarios on this)

Operational flexibility for off peak is unknown. Although, the State Water Project has data on this

Sheila Kuehl's bill (SB 820) asks for energy impact considerations in water use.

Afternoon Topic II

Trends

Federal effort covers water for energy. Does water shortage impact sustainability of electricity generation (hydro and power plants)? Need to include this.

DWR will pick this up. Minor impact for now

What new water equipment installed?

- Conjunctive use

Treatment requirements may get more stringent. Will treat more stuff (antibiotics, lipsticks, radioactivity, arsenic, hormones, etc…) Don't know energy costs of more stringent requirements. However, we do know about proposals; water agencies have working groups on this and EPA is looking at this. Energy Costs will be a significant cost of more stringent standards. Three technologies will be used to solve problem: UV, Ozonization, and Membrane.

Renewable technologies (PV and wind) in water/waste water industry are growing in importance.

Energy efficiency and cost effectiveness of existing water/wastewater treatment plants

Homeland security has hit water agencies hard; not an energy impact but a financial impact.

Treating drinking water: water treatment is smallest contributor to energy intensity (compared to conveyance, end-use, wastewater treatment, and distribution)

In the urban sector, customer end-use dominates. At the customer end-use level it is possible to save water and energy at the same time.

Water cooled chillers dominate energy intensity of end-use

For Ag., shipping to San Diego has big energy impacts.

In Agricultural sector, saving water may use more energy. Drip irrigation etc. may use more than flood irrigation.

Trend is towards agricultural users firming up water supply and delivering the same amount of water to urban uses. Everyone takes all their allotment. The amount going over the Tehachapi has been consistent over the years.

Change in environment use. For example, impact on amount for delta outflow is unknown

Urban is more energy intensive than Ag. , so transfers may increase energy use.

Trend is towards more level use of Water project. Proposition 50 has incentives for regions to use water more efficiently

Note: can data on end-use intensity be used for other parts of state? Answer: for residential sector, probably.

More efficient end-uses can have a rebound effect (i.e., longer showers with on-demand hot water heaters, etc.). In agricultural sector may lead to more productivity

Question is where future energy growth will be: conjunctive use rather than end-use)

Need to factor in time of use

Changes in process and technology implies lower water use (for example: cement making is going from wet to dry)

Housing construction

- location of water heaters versus fixtures
- new construction uses more peak water use than existing construction (due to irrigation systems wrongly programmed).
- Would like to see better new construction standards for system design

Percentage due to end use is underestimated statewide if you use San Diego use as a case study because San Diego is far from source of water so conveyance energy use is relatively large.

Closing Remarks

Working Group Process

- meet every 2 weeks
- next topic should be:
    - wastewater
    - Ag sector
    - ?
- next meeting of working group will be 3/24
- use e-mail
- April 8th will be next committee workshop